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DERIVATION OF DISCHARGES USED FOR FISH MOVEMENT AT CONWY FALLS (PROJECT NO. N0289) REPORT NO. N/90/1

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SUMMARY

1. This report describes derivation of the flow range used by salmon for movement in the upper Conwy, N. Wales. This information was required to recommend levels for the tunnel entrance of the proposed Conwy Falls fishpass.

2. On the basis of angling catch-flow relationships, it was estimated that 90% of salmon movement would occur within the discharge range 0.05 to 6 times the ADF station (17.37 cumecs) at Cwm Llanerch gauging station.

3. This result is briefly discussed in the context of published information on salmon flow requirements and sources of error in the anlaysis.

4. In addition to flow requirements, recommendations are made in relation to additional hdyrological analysis and monitoring of runs through the pass.

KEY WORDS: salmon, flow requirements, barriers, rod catch, fishpass

Derivation of discharges used for fish movement at Conwy Falls

1. INTRODUCTION

Proposals for a fishpass at Conwy Falls (NGR SH 809 535) involve construction of a tunnel around the falls in which a denil pass would be installed. The elevation of the downstream tunnel entrance is critical for ensuring fish passage, because it will not be equally accessible at all discharges. The design optimum would be to install it at a level that allows passage during flows when the greatest number of fish move. This report describes derivation of these flows for salmon.

Throughout this account discharges are referred to a downstream gauging station (Cwm Llanerch, NGR SH 802 581, ADF 17.37 cumecs) which includes 59% of the total catchment area compared with 30% at the falls. In a separate exercise the Hydrology section has related Cwm Llanerch discharge to discharge and levels at Conwy Falls.

2. METHODS

No direct observations on fish movement exist for the Conwy, therefore two alternative approaches were used.

(i) Inspection of empirical relationships from other rivers which have usually been derived from fish counter or catch-flow studies.

(ii) Analysis of salmon rod catch - mean daily flow (Cwm Llanerch) relationships for the Gwydyr Hotel fishery. This fishery takes approximately 30% of the total Conwy rod catch and is located in the upper part of the Conwy downstream of the Falls, including a section of the Lledr. Daily catch records and flows were analysed for the period 1976-1986.

3. RESULTS AND DISCUSSION

3.1. Literature based flows

Salmon movements (over fish counters) and rod catches have often been examined in relation to river discharge or other factors, and there are several reviews (Baxter, 1961; Brayshaw, 1966; Banks, 1969; Alabaster, 1970; Arnold, 1974; Fraser, 1975). From these previous studies and the very recent data coming from fish tracking work (Atlantic Salmon Trust, in preparation) the following themes, relevant to the Conwy, emerge.

(i) In general, median fish movement occurs at flows greater than the median flow available during any period.

(ii) Fish movements are stimulated by changing flow, or some factor associated with it. Although summer spates are effective in bringing fish up from an estuary, they will not necessarily stimulate further movement of fish already in the river. The peaks of large spates inhibit movement.

(iii) Within the limits of a broad 'migration band' (Cragg-Hine, 1989), flows utilised by salmon change during a season and frequently differ (when expressed as a proportion of the ADF) between rivers or the upper and lower reaches of large rivers.

(iv) The relationship between angling catch and flow is close to that between movements and flow. This is because catchability is high in moving fish and anglers therefore select flows when fish are moving.

For reasons noted above extrapolation from other rivers to the Conwy needs to be done with caution, but in general similar types of river, e.g. West coast spate rivers, tend to show similar relationships. Representative flow data from some other appropriate studies are summarised in Table 1, with the criteria used to assess them. These studies were generally intended to identify minimum or median flow

requirements rather than the full range used by salmon. These values show that any flow range recommended for the Conwy fishpass should at least encompass the range 30-150% ADF.

3.2. Conwy Salmon Catch Analysis

The productive angling season on this fishery extends from April to October, with peak catches in September (Table 2). When daily catches and frequency of flow occurrence are plotted against flow (Fig.1 for August example, Appendix I for other months) it is apparent that most fish are caught at intermediate values of discharge. In the context of the fishpass the objective is to identify flow range when most fish actually move/are caught. This was derived by plotting, for each month averaged over 1976-86, the cumulative catch against discharge (grouped in 2 cumec class intervals (Fig.2) for August example, Appendix II for all data). From this curve the discharges corresponding to 5% (Q_{c5}), 50% (Q_{c50}) and 95% (Q_{c95}) catch were estimated by eye (Table 3). The range Q_{c5} to Q_{c95} therefore covers 90% of the catch for each monthly period, and gives an overall inseason range of <1 to 100.0 cumecs (5% to 580% ADF). This represents the recommended range over which the fishpass should operate.

Two further aspects should be considered. Firstly, this analysis uses daily mean discharge (to correspond with daily catch). Over 24 hours during a spate instantaneous discharge can vary substantially. But radiotracking shows it is likely that movements will cease anyway on the big spates due to high water velocities, particularly in a narrow torrential gorge such as that where the falls are situated.

Applying the upper limit (100 cumecs) to the Conwy flow duration curve

indicates that this flow is exceeded annually 1.9% of the time (= 7 days). In terms of instantaneous flow this exceedance may be rather higher, but over the months when most fish are moving within season the proportion of time when fish cannot move is still acceptable. It is likely that a significant proportion of fish will continue to move into the upper river after the angling season, during November and early December. However, their flow requirements will be no more stringent than inseason fish and they will be able to move over the recommended flows.

Secondly, no fishing effort data were available. The effect of this will be to bias catches to times (flows) when most anglers go fishing. Anglers naturally tend to select flows when fish are catchable (i.e. moving) so this should not introduce a serious systematic bias that would invalidate the flow range estimate. Some fish may move on higher flows when angling is not possible; and a small amount of successful angling is carried out in flows up to 140 cumecs (see Appendix II). However, as noted above the incidence of such flows is very low; and in any event radiotracking demonstrates that fish temporarily delayed will resume upstream movement as flows recede, particularly during spawning run time (October - December) when the migration urge is strong.

The median catch flows (Table 3) are consistently higher than the median available flows in each month (Table 2), and their range (8.8 to 18.0 cumecs) corresponds closely to those extrapolated from other studies (Table 1).

4. CONCLUSIONS

4.1. On the basis of rod catch-flow analysis, the range of mean daily discharge over which 90% of salmon move in the upper Conwy is <1 to 100 cumecs (equivalent to 0.05 to 6 times ADF). This range encompasses the flows at which salmon are known to move on other rivers similar to the Conwy.

4.2. A small proportion of salmon may move at higher discharge, but the frequency of such events is low (<2% per annum). Any delay is likely to be temporary and occur at flows which are high enough to prevent increased poaching risk below the falls.

4.3. Although this analysis is based on salmon the recommended flows will also enable sea trout migration in this part of the river.

5. RECOMMENDATIONS

5.1. The fishpass downstream entrance should be designed to operate between levels corresponding to Cwm Llanerch discharge range 0.05 to 6 times ADF (17.37 cumecs).

5.2. An assessment should be made (using instantaneous flow data) of the number of days in each month throughout the year that the pass would not allow passage (i.e. discharges >100 cumecs) in order to check any error introduced by the unavoidable use of mean daily flow in this analysis.

5.3. Monitoring of fish passage through the pass in relation to discharge should be carried out to check against these predictions. Installation of an Aquantic resistivity fish counter would be appropriate.

ACKNOWLEDGEMENTS

I. Davidson carried out much of the data collection and initial analysis. We thank the owners of the Gwydyr Hotel Fishery for access to their fishery records.

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TABLE 1 - Typical salmon movement or catch-flow data from British rivers

Reference	Criterion	% ADF	Equivalent[2] Conwy Q (cumecs)
Baxter (1961)	Salmon movement middle/lower rivers	30-50	5.2-8.7
	" " upper rivers	70	12.2
Brayshaw (1966)	Salmon movement (trap & counter) and successful angling reach peak over range	70-150	12.2-26.1
Stewart (1969)[1]	1. Migration commences at 0.083 cumecs/m	17	2.9
	2. Peak migration at 0.200 cumecs/m	40	7.0
	3. Angling becomes productive 0.293 cumecs/m	59	10.3
Gee (1980)	Median-catch-flow, lower river Wye	43	7.5
	" " " upper " "	76	13.2

1 Stewart's flow recommendations are expressed as cumecs/metre river width to account for river size differences; % ADF values and flows are calculated for Cwm Llanerch using average width of 35m.

2 Conwy ADF at Cwm Llanerch = 17.37 cumecs.

TABLE 2: Seasonal variation in discharge (Cwm Llanerch) and salmon rod catch (Gwydyr fishery) averaged over 1976-1986.

	FLOW (cumecs)			CATCH	
MONTH	95%	50%	5%	MEAN	S.D.
APRIL	<2	5.2	32.0	6.18	± 7.85
MAY	<2	4.8	29.0	26.55	± 17.39
JUNE	<2	3.6	20.0	15.10	± 11.40
JULY	<2	<2	18.5	15.46	± 10.25
AUG.	<2	4.6	43.0	38.36	± 29.90
SEPT.	<2	8.6	52.0	74.46	± 32.74
OCT.	<2	12.5	74.0	33.82	± 15.08

NOTE : FLOW 50% = Flow below which 50% of flow days within a month occur

TABLE 3: Seasonal variation in cumulative catch-discharge relationship, averaged over 1976-1986.

	FLOW (cumecs)*		
MONTH	Q(c5%)	Q(c50%)	Q(c95%)
APRIL	2.3	9.8	41.0
MAY	<1	8.8	51.0
JUNE	1.4	9.6	31.5
JULY	<1	8.5	41.5
AUG.	1.7	15.5	100.0
SEPT.	3.0	16.5	73.0
OCT.	5.3	18.0	61.0

* Flow at which 5, 50, 95% of monthly cumulative catch is taken

FIG. 1: RELATIONSHIP BETWEEN FLOW, FLOW DAYS AND CATCH, AUGUST 1976-1986.

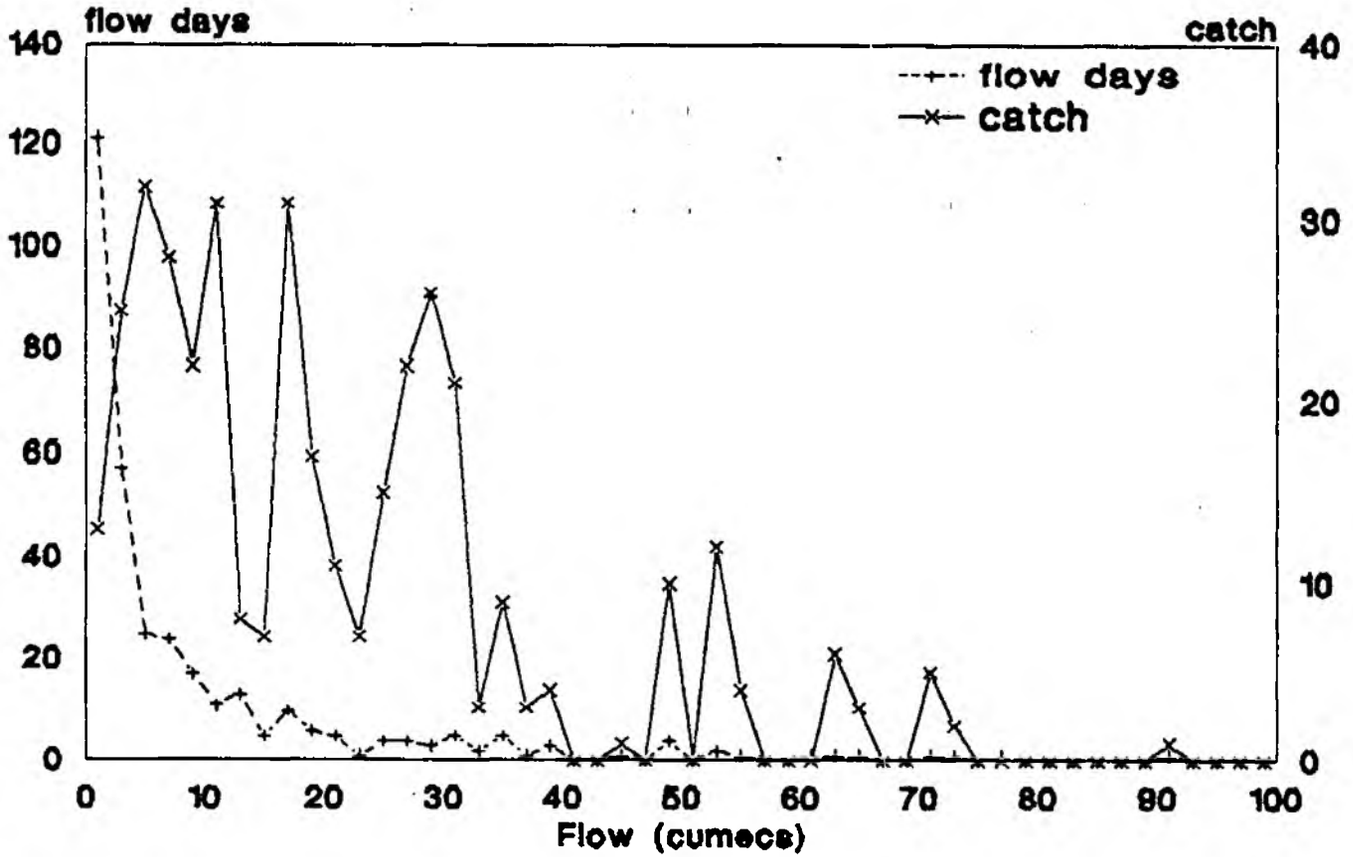
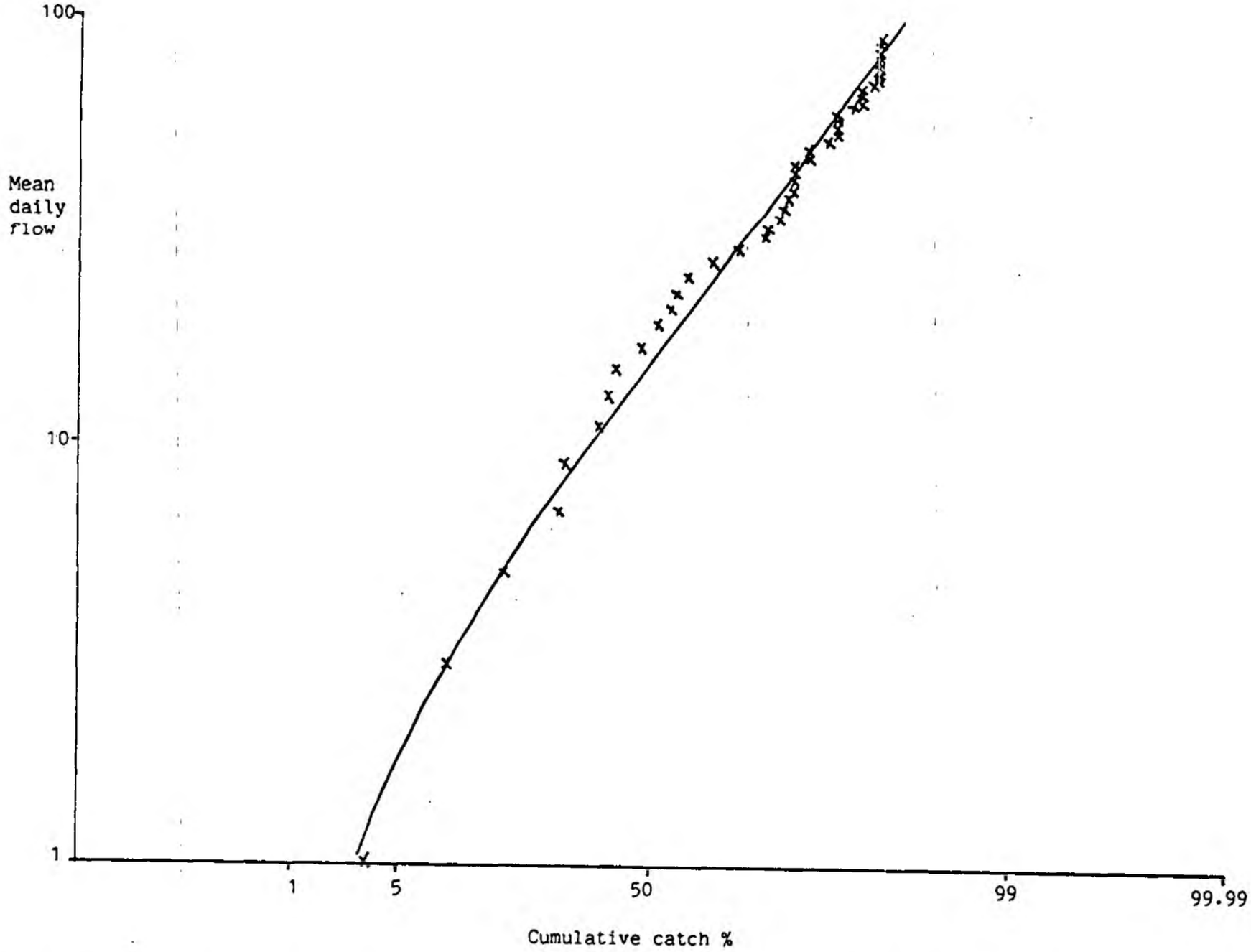
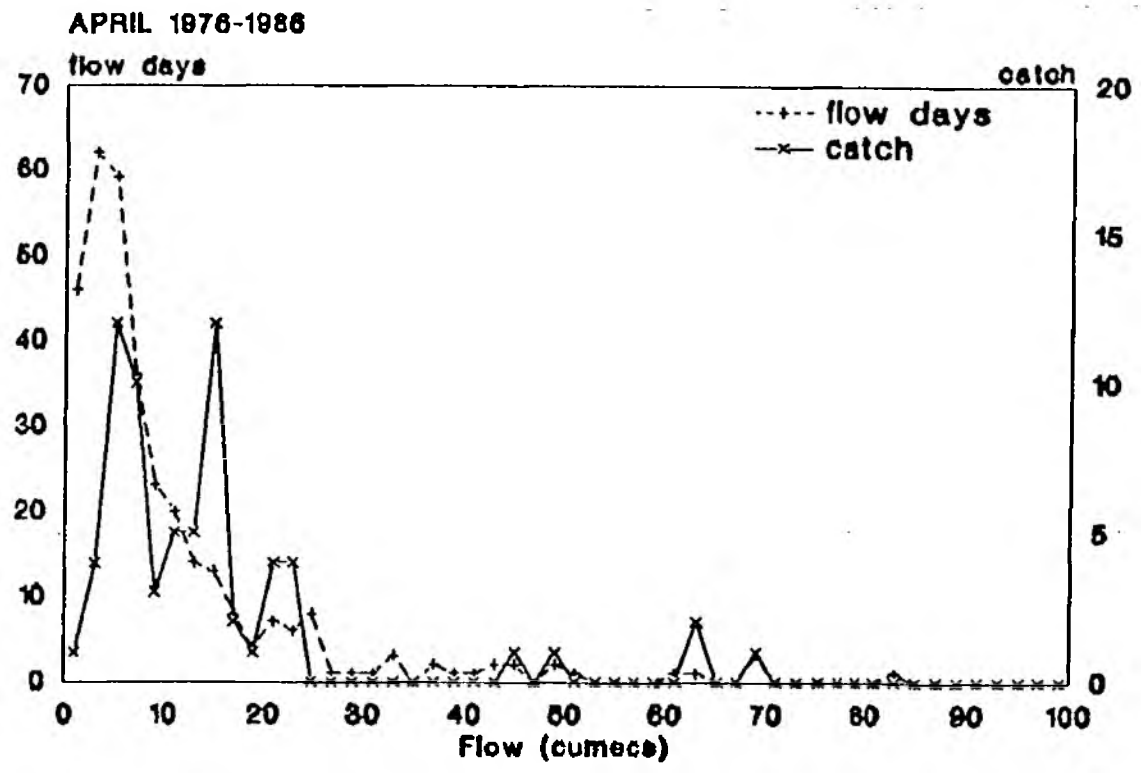
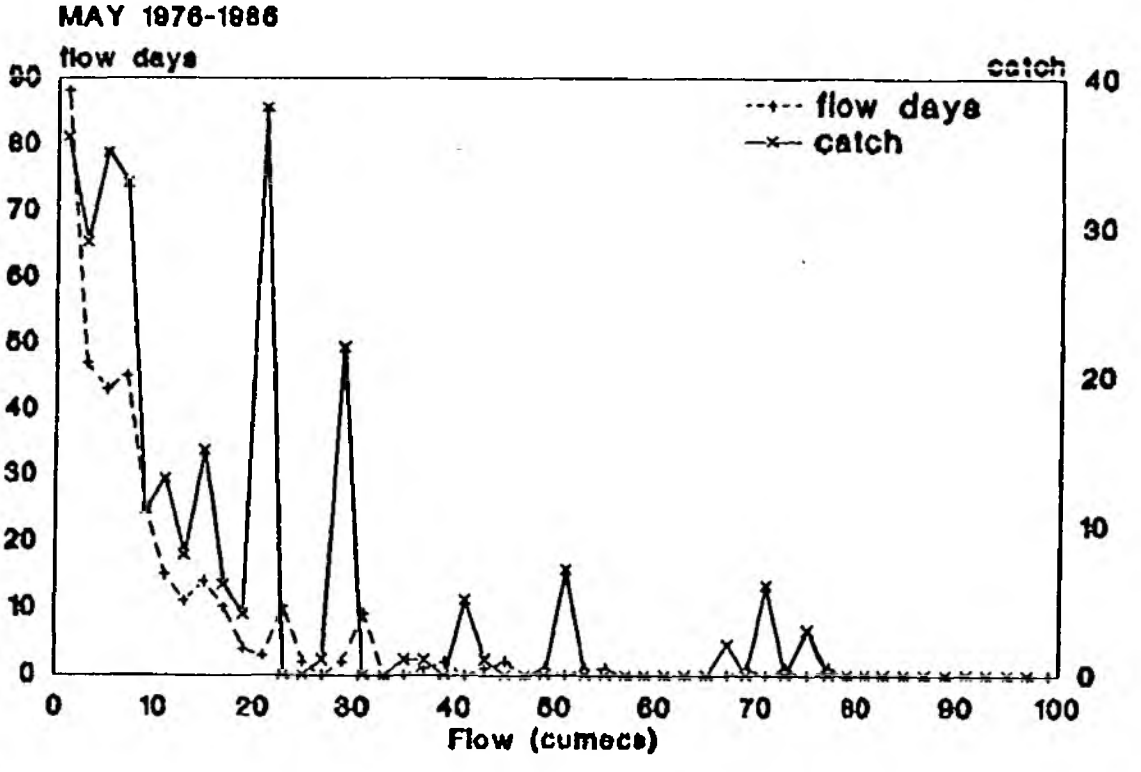


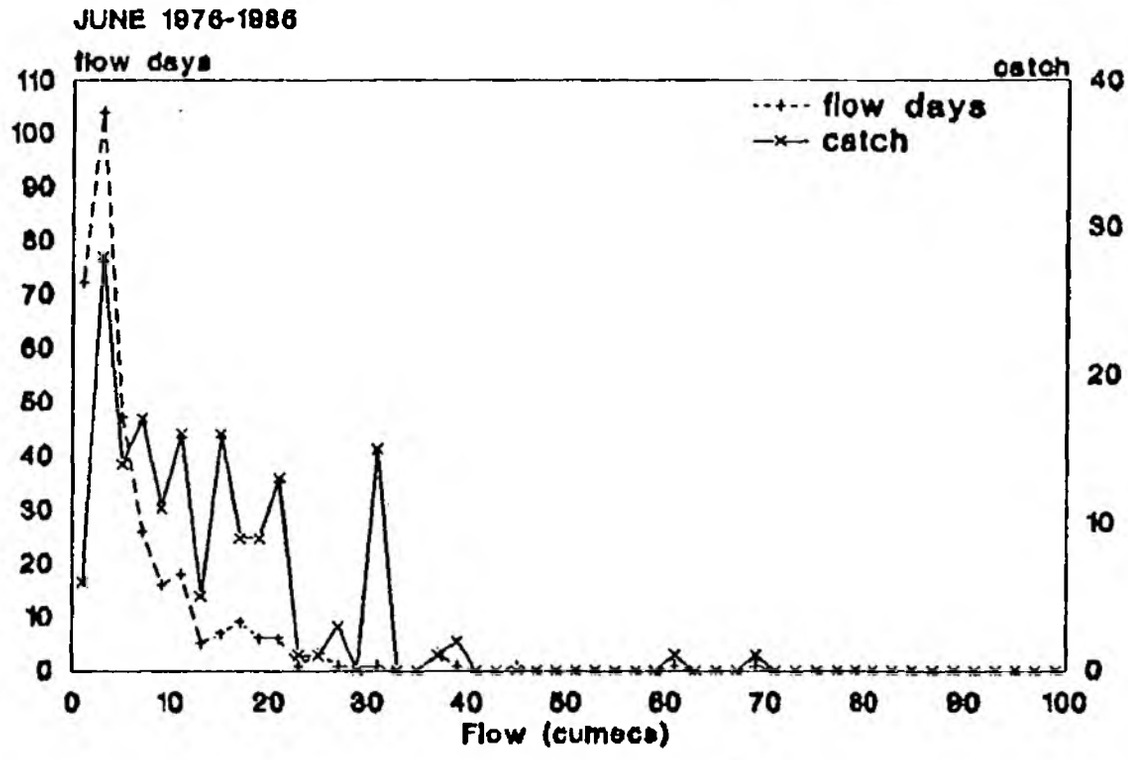
FIG.2 Flow and cumulative catch % relationship, August 1976-1986

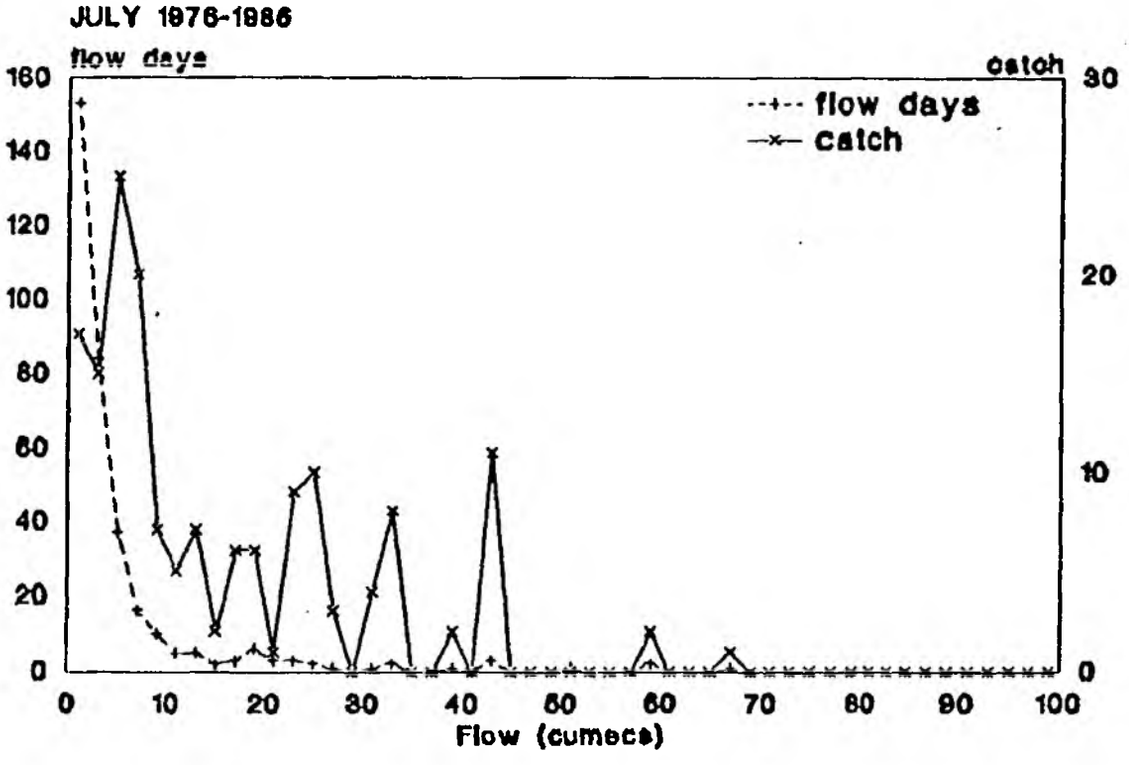


APPENDIX I Monthly flow day & catch relationships
(April to October 1976-86)

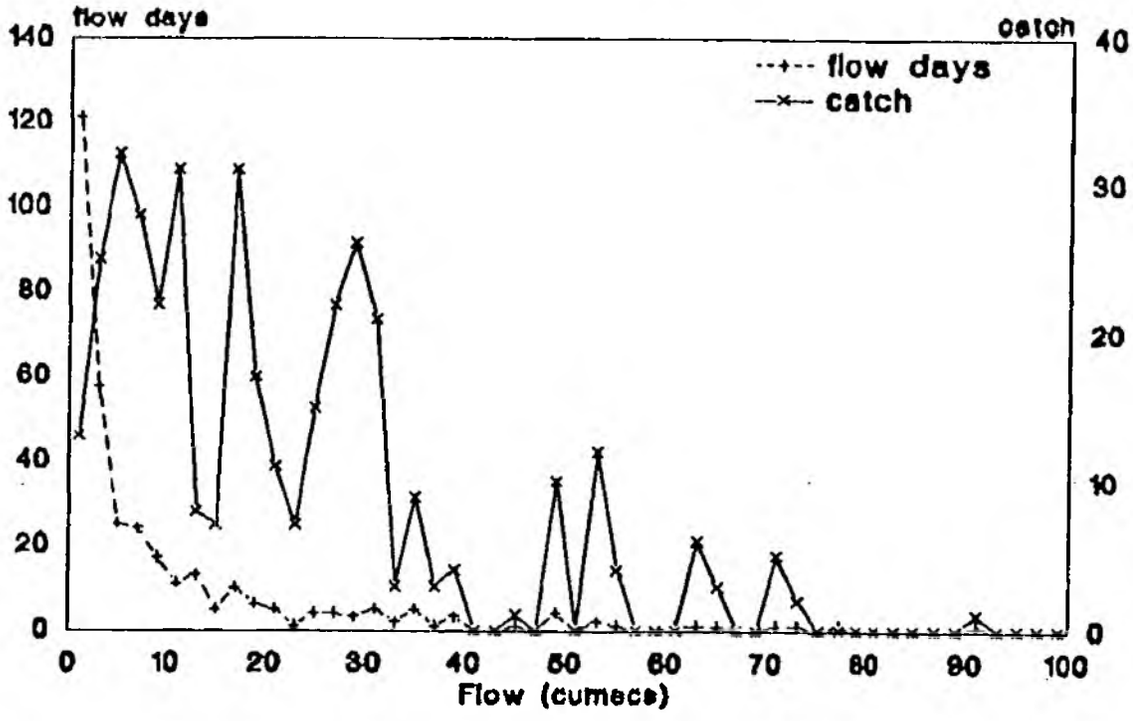




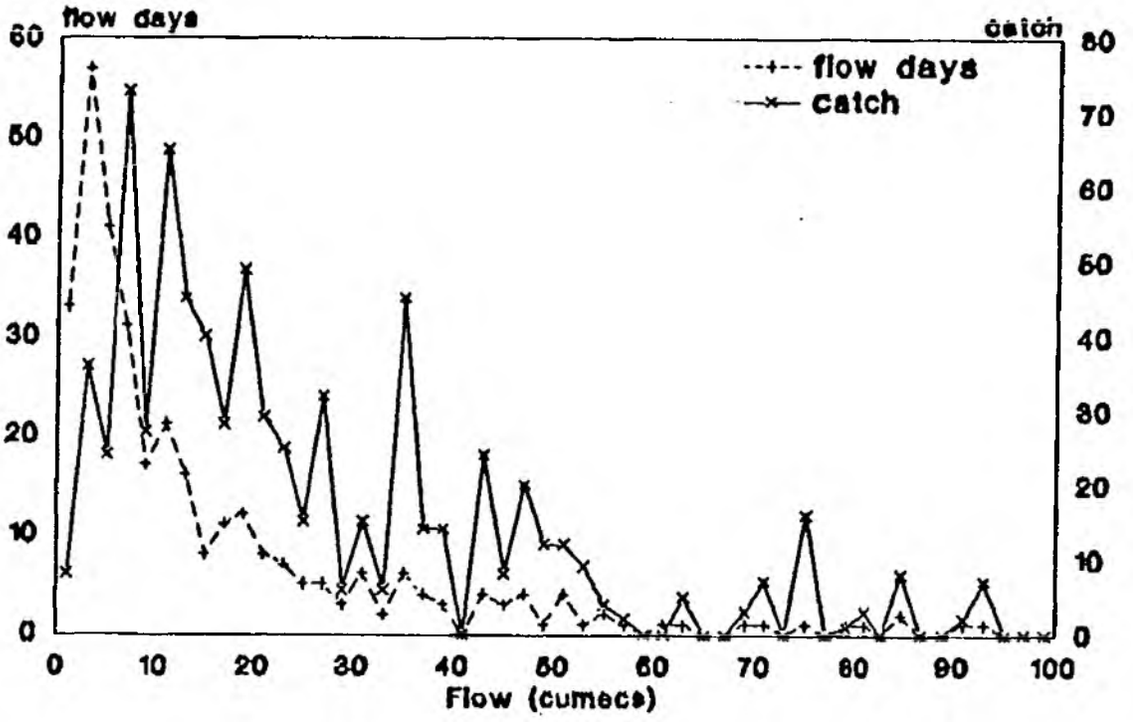

JUNE 1976-1986
flow days
catch
flow days
catch
110
100
90
80
70
60
50
40
30
20
10
0
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
Flow (cumecs)

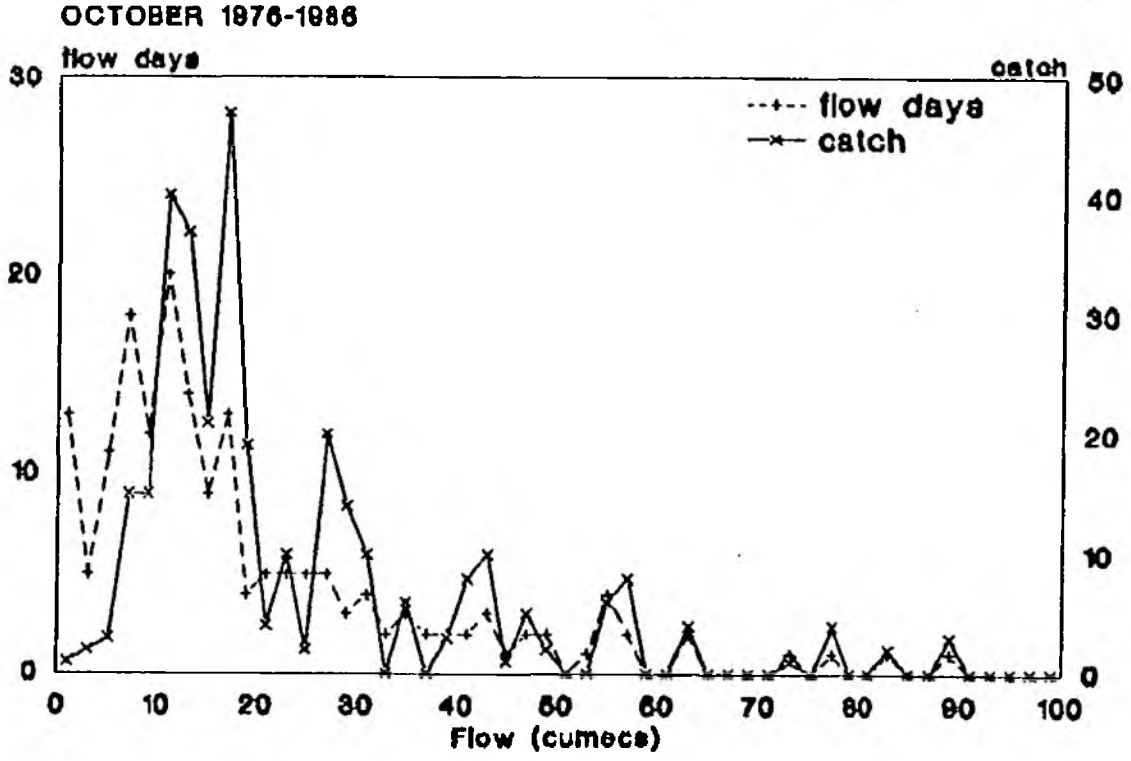

JULY 1976-1986
flow days
catch
flow days
catch
160
140
120
100
80
60
40
20
0
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
Flow (cumecs)

AUGUST 1976-1986



SEPTEMBER 1976-1986




OCTOBER 1976-1986
flow days
catch
flow days
catch
30
20
10
0
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
Flow (cumecs)

APPENDIX II Monthly flow and catch data

APRIL 1976-1986

FLOW (CUMECS)	FLOW DAYS	CTCH	CUM CTCH	% CUM CTCH
1	46	1	1	1.47
3	42	4	5	7.35
5	59	12	17	25.00
7	36	10	27	39.71
9	23	3	30	44.12
11	20	5	35	51.47
13	14	5	40	58.82
15	13	12	52	76.47
17	8	2	54	79.41
19	4	1	55	80.88
21	7	4	59	86.76
23	6	4	63	92.65
25	8	0	63	92.65
27	1	0	63	92.65
29	1	0	63	92.65
31	1	0	63	92.65
33	3	0	63	92.65
35	0	0	63	92.65
37	2	0	63	92.65
39	1	0	63	92.65
41	1	0	63	92.65
43	2	0	63	92.65
45	2	1	64	94.12
47	0	0	64	94.12
49	2	1	65	95.59
51	1	0	65	95.59
53	0	0	65	95.59
55	0	0	65	95.59
57	0	0	65	95.59
59	0	0	65	95.59
61	1	0	65	95.59
63	1	2	67	98.53
65	0	0	67	98.53
67	0	0	67	98.53
69	3	1	68	100.00
71	0	0	68	100.00
73	0	0	68	100.00
75	0	0	68	100.00
77	0	0	68	100.00
79	0	0	68	100.00
81	0	0	68	100.00
83	1	0	68	100.00
85	0	0	68	100.00
87	0	0	68	100.00
89	0	0	68	100.00
91	0	0	68	100.00
93	0	0	68	100.00
95	0	0	68	100.00
97	0	0	68	100.00
99	0	0	68	100.00
101	0	0	68	100.00
103	0	0	68	100.00
105	1	0	68	100.00
107	0	0	68	100.00
109	0	0	68	100.00
111	0	0	68	100.00
113	0	0	68	100.00
115	0	0	68	100.00
117	0	0	68	100.00
119	0	0	68	100.00
121	0	0	68	100.00
123	0	0	68	100.00
125	0	0	68	100.00
127	0	0	68	100.00
129	0	0	68	100.00
131	0	0	68	100.00
133	0	0	68	100.00
135	0	0	68	100.00
137	0	0	68	100.00
139	0	0	68	100.00

MAY 1976-1986

FLOW (CUMECS)	FLOW DAYS	CTCH	CUM CTCH	% CUM CTCH
1	88	36	36	11.50
3	47	36	72	23.00
5	43	29	101	32.27
7	45	35	136	43.45
9	25	33	169	53.99
11	19	11	180	57.51
13	11	13	193	61.66
15	14	8	201	64.22
17	10	15	216	69.01
19	4	6	222	70.93
21	3	4	226	72.20
23	10	38	264	84.35
25	2	0	264	84.35
27	0	0	264	84.35
29	2	1	265	84.66
31	9	22	287	91.69
33	0	0	287	91.69
35	0	0	287	91.69
37	1	1	288	92.01
39	2	1	289	92.33
41	0	0	289	92.33
43	1	5	294	93.93
45	2	1	295	94.25
47	0	0	295	94.25
49	1	0	295	94.25
51	0	0	295	94.25
53	1	7	302	96.49
55	1	0	302	96.49
57	0	0	302	96.49
59	0	0	302	96.49
61	0	0	302	96.49
63	0	0	302	96.49
65	0	0	302	96.49
67	0	0	302	96.49
69	1	2	304	97.12
71	0	0	304	97.12
73	1	6	310	99.04
75	0	0	310	99.04
77	1	3	313	100.00
79	0	0	313	100.00
81	0	0	313	100.00
83	0	0	313	100.00
85	0	0	313	100.00
87	0	0	313	100.00
89	0	0	313	100.00
91	0	0	313	100.00
93	0	0	313	100.00
95	0	0	313	100.00
97	0	0	313	100.00
99	0	0	313	100.00
101	0	0	313	100.00
103	0	0	313	100.00
105	0	0	313	100.00
107	0	0	313	100.00
109	0	0	313	100.00
111	0	0	313	100.00
113	0	0	313	100.00
115	0	0	313	100.00
117	0	0	313	100.00
119	0	0	313	100.00
121	0	0	313	100.00
123	0	0	313	100.00
125	0	0	313	100.00
127	0	0	313	100.00
129	0	0	313	100.00
131	0	0	313	100.00
133	0	0	313	100.00
135	0	0	313	100.00
137	0	0	313	100.00
139	0	0	313	100.00

JUNE 1976-1986

FLOW (CUMECS)	FLOW DAYS	CTCH	CUM CTCH	% CUM CTCH
1	72	6	6	3.55
3	104	28	34	20.12
5	47	14	48	28.40
7	26	17	65	38.46
9	16	11	76	44.97
11	18	16	92	54.44
13	5	5	97	57.40
15	7	16	113	66.86
17	9	9	122	72.19
19	6	9	131	77.51
21	6	13	144	85.21
23	1	1	145	85.80
25	3	1	146	86.39
27	1	3	149	88.17
29	1	0	149	88.17
31	1	15	164	97.04
33	0	0	164	97.04
35	0	0	164	97.04
37	3	1	165	97.63
39	1	2	167	98.82
41	0	0	167	98.82
43	0	0	167	98.82
45	1	0	167	98.82
47	0	0	167	98.82
49	0	0	167	98.82
51	0	0	167	98.82
53	0	0	167	98.82
55	0	0	167	98.82
57	0	0	167	98.82
59	0	0	167	98.82
61	1	1	168	99.41
63	0	0	168	99.41
65	0	0	168	99.41
67	0	0	168	99.41
69	1	1	169	100.00
71	0	0	169	100.00
73	0	0	169	100.00
75	0	0	169	100.00
77	0	0	169	100.00
79	0	0	169	100.00
81	0	0	169	100.00
83	0	0	169	100.00
85	0	0	169	100.00
87	0	0	169	100.00
89	0	0	169	100.00
91	0	0	169	100.00
93	0	0	169	100.00
95	0	0	169	100.00
97	0	0	169	100.00
99	0	0	169	100.00
101	0	0	169	100.00
103	0	0	169	100.00
105	0	0	169	100.00
107	0	0	169	100.00
109	0	0	169	100.00
111	0	0	169	100.00
113	0	0	169	100.00
115	0	0	169	100.00
117	0	0	169	100.00
119	0	0	169	100.00
121	0	0	169	100.00
123	0	0	169	100.00
125	0	0	169	100.00
127	0	0	169	100.00
129	0	0	169	100.00
131	0	0	169	100.00
133	0	0	169	100.00
135	0	0	169	100.00
137	0	0	169	100.00
139	0	0	169	100.00

JULY 1976-1986:

FLOW (CUMECS)	FLOW DAYS	CTCH	CUM CTCH	% CUM CTCH
1	153	17	17	10.56
3	84	15	32	19.88
5	37	25	57	35.40
7	16	20	77	47.83
9	10	7	84	52.17
11	5	5	89	55.28
13	5	7	96	59.63
15	2	2	98	60.87
17	3	6	104	64.60
19	6	6	110	68.32
21	3	1	111	68.94
23	3	9	120	74.53
25	2	10	130	80.75
27	1	3	133	82.61
29	0	0	133	82.61
31	1	4	137	85.09
33	2	8	145	90.06
35	0	0	145	90.06
37	0	0	145	90.06
39	1	2	147	91.30
41	0	0	147	91.30
43	3	11	158	98.14
45	0	0	158	98.14
47	0	0	158	98.14
49	0	0	158	98.14
51	1	0	158	98.14
53	0	0	158	98.14
55	0	0	158	98.14
57	0	0	158	98.14
59	2	2	160	99.38
61	0	0	160	99.38
63	0	0	160	99.38
65	0	0	160	99.38
67	1	1	161	100.00
69	0	0	161	100.00
71	0	0	161	100.00
73	0	0	161	100.00
75	0	0	161	100.00
77	0	0	161	100.00
79	0	0	161	100.00
81	0	0	161	100.00
83	0	0	161	100.00
85	0	0	161	100.00
87	0	0	161	100.00
89	0	0	161	100.00
91	0	0	161	100.00
93	0	0	161	100.00
95	0	0	161	100.00
97	0	0	161	100.00
99	0	0	161	100.00
101	0	0	161	100.00
103	0	0	161	100.00
105	0	0	161	100.00
107	0	0	161	100.00
109	0	0	161	100.00
111	0	0	161	100.00
113	0	0	161	100.00
115	0	0	161	100.00
117	0	0	161	100.00
119	0	0	161	100.00
121	0	0	161	100.00
123	0	0	161	100.00
125	0	0	161	100.00
127	0	0	161	100.00
129	0	0	161	100.00
131	0	0	161	100.00
133	0	0	161	100.00
135	0	0	161	100.00
137	0	0	161	100.00
139	0	0	161	100.00

AUGUST 1976-1986:

FLOW (CUMECS)	FLOW DAYS	CTCH	CUM CTCH	% CUM CTCH
1	121	13	13	3.19
3	57	25	38	9.31
5	25	32	70	17.16
7	24	28	98	24.02
9	17	22	120	29.41
11	11	31	151	37.01
13	13	8	159	38.97
15	5	7	166	40.69
17	16	31	197	48.28
19	6	17	214	52.45
21	5	11	225	55.15
23	1	7	232	56.86
25	4	15	247	60.54
27	4	22	269	65.93
29	3	26	295	72.30
31	5	21	316	77.45
33	2	3	319	78.19
35	5	9	328	80.39
37	1	3	331	81.13
39	3	4	335	82.11
41	0	0	335	82.11
43	0	0	335	82.11
45	1	1	336	82.35
47	0	0	336	82.35
49	4	10	346	84.80
51	0	0	346	84.80
53	2	12	358	87.75
55	1	4	362	88.73
57	0	0	362	88.73
59	0	0	362	88.73
61	1	0	362	88.73
63	1	6	368	90.20
65	1	3	371	90.93
67	0	0	371	90.93
69	0	0	371	90.93
71	1	5	376	92.16
73	1	2	378	92.65
75	0	0	378	92.65
77	1	0	378	92.65
79	0	0	378	92.65
81	0	0	378	92.65
83	0	0	378	92.65
85	0	0	378	92.65
87	0	0	378	92.65
89	0	0	378	92.65
91	1	1	379	92.89
93	0	0	379	92.89
95	0	0	379	92.89
97	0	0	379	92.89
99	0	0	379	92.89
101	0	0	379	92.89
103	1	9	388	95.10
105	1	0	388	95.10
107	0	0	388	95.10
109	0	0	388	95.10
111	0	0	388	95.10
113	0	0	388	95.10
115	0	0	388	95.10
117	0	0	388	95.10
119	1	18	406	99.51
121	1	2	408	100.00
123	0	0	408	100.00
125	0	0	408	100.00
127	0	0	408	100.00
129	0	0	408	100.00
131	0	0	408	100.00
133	0	0	408	100.00
135	0	0	408	100.00
137	0	0	408	100.00
139	0	0	408	100.00

SEPTEMBER 1976-1986:

FLOW (CUMECS)	FLOW DAYS	CTCH	CUM CTCH	% CUM CTCH
1	33	8	8	1.08
3	57	36	44	5.95
5	41	24	68	9.19
7	31	73	141	19.05
9	17	27	168	22.70
11	21	65	233	31.49
13	16	45	278	37.57
15	8	40	318	42.97
17	11	28	346	46.76
19	12	49	395	53.38
21	8	29	424	57.30
23	7	25	449	60.68
25	5	15	464	62.70
27	5	32	496	67.03
29	3	6	502	67.84
31	6	15	517	69.86
33	2	6	523	70.68
35	6	45	568	76.76
37	4	14	582	78.65
39	3	14	596	80.54
41	0	0	596	80.54
43	4	24	620	83.78
45	3	8	628	84.86
47	4	20	648	87.57
49	1	12	660	89.19
51	4	12	672	90.81
53	1	9	681	92.03
55	2	4	685	92.57
57	1	2	687	92.84
59	0	0	687	92.84
61	1	0	687	92.84
63	1	5	692	93.51
65	0	0	692	93.51
67	0	0	692	93.51
69	1	3	695	93.92
71	1	7	702	94.86
73	0	0	702	94.86
75	1	16	718	97.03
77	0	0	718	97.03
79	1	1	719	97.16
81	1	3	722	97.57
83	0	0	722	97.57
85	2	8	730	98.65
87	0	0	730	98.65
89	0	0	730	98.65
91	1	2	732	98.92
93	1	7	739	99.86
95	0	0	739	99.86
97	0	0	739	99.86
99	0	0	739	99.86
101	0	0	739	99.86
103	0	0	739	99.86
105	0	0	739	99.86
107	0	0	739	99.86
109	0	0	739	99.86
111	0	0	739	99.86
113	0	0	739	99.86
115	0	0	739	99.86
117	0	0	739	99.86
119	1	0	739	99.86
121	0	0	739	99.86
123	0	0	739	99.86
125	0	0	739	99.86
127	0	0	739	99.86
129	0	0	739	99.86
131	1	0	739	99.86
133	0	1	740	100.00
135	0	0	740	100.00
137	0	0	740	100.00
139	0	0	740	100.00

OCTOBER 1976-1986

FLOW (CUMECS)	FLOW DAYS	CICH	CUM CICH	% CUM CICH
1	13	1	1	.30
3	5	2	3	.91
5	11	3	6	1.83
7	18	15	21	6.40
9	12	15	36	10.98
11	20	40	76	23.17
13	14	37	113	34.45
15	9	21	134	40.85
17	13	47	181	55.18
19	4	19	200	60.98
21	5	4	204	62.20
23	5	10	214	65.24
25	5	2	216	65.85
27	5	20	236	71.95
29	3	14	250	76.22
31	4	10	260	79.27
33	2	0	260	79.27
35	3	6	266	81.10
37	2	0	266	81.10
39	2	3	269	82.01
41	2	8	277	84.45
43	3	10	287	87.50
45	1	1	288	87.80
47	2	5	293	89.33
49	2	2	295	89.94
51	0	0	295	89.94
53	1	0	295	89.94
55	4	6	301	91.77
57	2	8	309	94.21
59	0	0	309	94.21
61	0	0	309	94.21
63	2	4	313	95.43
65	0	0	313	95.43
67	0	0	313	95.43
69	0	0	313	95.43
71	0	0	313	95.43
73	1	1	314	95.73
75	0	0	314	95.73
77	1	4	318	96.95
79	0	0	318	96.95
81	0	0	318	96.95
83	1	2	320	97.56
85	0	0	320	97.56
87	0	0	320	97.56
89	1	3	323	98.48
91	0	0	323	98.48
93	0	0	323	98.48
95	0	0	323	98.48
97	0	0	323	98.48
99	0	0	323	98.48
101	0	0	323	98.48
103	0	0	323	98.48
105	0	0	323	98.48
107	0	0	323	98.48
109	1	0	323	98.48
111	0	0	323	98.48
113	0	0	323	98.48
115	0	0	323	98.48
117	0	0	323	98.48
119	0	0	323	98.48
121	0	0	323	98.48
123	2	3	326	99.39
125	1	1	327	99.70
127	0	0	327	99.70
129	0	0	327	99.70
131	0	0	327	99.70
133	1	0	327	99.70
135	1	0	327	99.70
137	1	1	328	100.00
139	0	0	328	100.00